Applicants have amended the claims to more particularly define that which they regard as the present invention.

Claim 2 has been amended by rewriting it in independent form, including the recitations of the process of claim 1 from which claim 2 depended. Support for the amended claim 2 is replete throughout the application, such as is found in cancelled claim 1, on page 6, lines 22 to 25, on pages 9 to10 and pages 15 to 16, of the specification.

Claim 14 has been amended by reciting a hydroxyalkylating reagent to dicarboxylic acid-functionalized material molar ratio of from about 3.8 to about 4.5. Support for this amendment is also replete throughout the application, such as is found in examples 1, 2, 6, 7 and 8: example 1 with a ratio of 4.1, example 2 with a ratio of 4.5, example 6 with a ratio of 3.8, example 7 with a ratio of 4.4 and example 8 with a ratio of 4.2. Accordingly, a molar ratio of from about 3.8 to about 4.5 is fully supported by the specification.

New Claim 21 has been added to more particularly define the carboxyl-functional groups of the dicarboxylic acid-functionalized material. Support for this new claim is replete throughout the application, such as those found in cancelled claim 1, on pages 9 to10 and pages 15 to 16, of the specification.

New Claim 22 has been added to more particularly define the molecular weight of the dicarboxylic acid-functionalized material. Support for this new claim is replete throughout the application, such as is found in cancelled claim 1, page 10, lines 30 to 36 and pages 15 to 16, particularly page 16, lines 7 to 8, of the specification.

No new matter has been introduced by the amendments or the new claims.

Applicants have not renumbered the claims or changed their dependence. However, Applicants will provide renumbering and dependence of the claims when allowable subject matter is indicated.

Claim 14 has been rejected under 35 U.S.C. § 132 for introducing new matter and under 35 U.S.C. § 112, first paragraph, as being subject matter not adequately described in the specification. Applicants have amended claim 14 by providing a molar ratio of from about 3.8 to about 4.5, which is fully supported by the specification as described above. Therefore, the 35 U.S.C. § 132 and 35 U.S.C. § 112, first paragraph, rejections should be withdrawn and claim 14 should be allowed.

Claims 1-5, 8-9 and 12-15 have been rejected under 35 U.S.C. § 112, second paragraph, as being indefinite.

Claims 1 and 8 have been canceled. Therefore, rejection of claims 1 and 8 is moot. The Examiner has alleged in the Action that claims 2 and 9 are indefinite because claims 1 and 8 do not provide an antecedent basis for using combinations of dicarboxylic acid-functionalized materials.

Applicants have amended claim 2. Support for using combinations of dicarboxylic acid-functionalized materials in claims 2 is on page 6, lines 22 to 25, of the specification. Thus, the use of a plurality of dicarboxylic acid-functionalized materials is clearly contemplated.

Claim 2, as amended, does not require an antecedent basis. Thus, claim 2, and claims 3-5, 9 and 12-15 (which depend therefrom) would not be indefinite for lack of antecedent basis, i.e., upon renumbering the claims and making the appropriate changes to their dependence. Therefore, the 35 U.S.C. § 112, second paragraph, rejection of claims 2-5, 9 and 12-15 should be withdrawn and claims 2-5, 9 and 12-15 should be allowed.

Claims 1-5, 8-9 and 12-15 have been rejected under 35 U.S.C. § 103 (a) as being allegedly obvious over U.S. Patent No. 4,444,692 to Okamoto (hereafter Okamoto) in view of Examiner's Notice, in further view of U.S. Patent No. 4,266,046 to Wu (hereafter Wu) or "Synthetic Studies with Carbonates. Part 6. Syntheses of 2-Hydroxyethyl Derivatives by Reactions of Ethylene Carbonate with carboxylic Acids or Heterocycles in the Presence of Tetraethylammonium Halides or under Autocatalytic Conditions", J.C.S. Perkin I, 1266-72 (1977) by Yoshino (hereafter Yoshino).

Claims 1 and 8 have been canceled. Therefore, rejection of claims 1 and 8 is moot.

Okamoto describes a process for preparing a hydroxyl-terminated polymer using:

(a) ethylene oxide; and

(b) a tertiary amine catalyst.

The Examiner's Notice is that ethylene oxide is a hazardous material and therefore, would be undesirable to use as a reactant.

Wu describes a process for preparing polyesters of polycarboxylic acids using a cyclic carbonate with a monomeric polyfunctional carboxylic acid in the presence of an alkylammonium halide catalyst. The monomeric polyfunctional carboxylic acid is derived from a hydrocarbon and includes the following acids (see column 3, lines 8 to 25):

> "The above-described cyclic carbonate esters of vicinal diols are utilized to react with polycarboxylic acids having the general formula $Z(CO_2H)_n$ wherein Z is a hydrocarbon radical having the valence equal to n and wherein n is an integer having a value from 2 to 4. Examples of suitable polycarboxylic acids which can be utilized in the instant invention include oxalic acid, malonic acid, succinic acid, glutaric acid, adipic acid, suberic acid, azelaic acid, sebacic acid, 1,2,3-propanetricarboxylic acid, 1,2-cyclohexane dicarboxylic acid, 1,4-cyclohexane

dicarboxylic acid, phthalic acid, isophthalic acid, terephthalic acid, 1,3,5-benzene tricarboxylic acid (trimesic acid), 1,2,4-benzene tricarboxylic acid (trimellitic acid), 1,2,4,5-benzene tetracarboxylic acid (pyromellitic acid), and the like. The instant invention is believed to have its greatest utility in the utilization of the cyclic carbonate esters described above for the esterification of aromatic polycarboxylic acids in the preparation of polyesters which are of widely known utility. Thus, a preferred group of polycarboxylic acids within those described by the general formula above are those wherein Z is an aromatic hydrocarbon radical."

Yoshino describes preparation of a mixture of mono- and di-esters of ethylene glycol with a mono-carboxylic acid by the reaction of a monocarboxylic acid with ethylene carbonate in the presence of an alkylammonium halide catalyst.

The 35 U.S.C. § 103 (a) rejection is based on Okamoto in view of Examiner's Notice and further in view of Wu or Yoshino.

Rejection Based on Okamoto in view of Examiner's Notice and further in view of Wu:

This combination does not render the instant claims obvious because Okamoto does not disclose or suggest modifying the process to overcome the disadvantages of using ethylene oxide. In fact, Okamoto teaches away from using any reagent other than ethylene oxide (see column 3, lines 48 to 55). In describing the ease of removal of the impurities from the reaction product, Okamoto does not even recognize that ethylene oxide may have a disadvantage, or that there is a need to overcome the disadvantage, let alone suggest that alkylene carbonate can overcome such disadvantages originating from ethylene oxide. Thus, Okamoto does not provide motivation to a person of ordinary skill in the art to explore the vast literature in the relevant art to locate a replacement for ethylene oxide, because Okamoto does not recognize the disadvantages of ethylene oxide.

Concerning the Examiner's Notice, Applicants specifically challenge the Examiner's Notice. If the information relied upon by the Examiner's Notice is well known, then the Examiner should be able to provide a reference that contains that information. However, if such a reference is not available, the Examiner should withdraw what is being relied upon as a reference.

Applicants point out that nearly all chemicals used in the chemical industry, including ethylene oxide, are toxic to one degree or another to humans, animals and the environment. Despite this, millions of pounds of ethylene oxide are produced annually by the chemical industry. Furthermore, millions of pounds of ethylene oxide are used annually by the chemical industry to produce a large number of downstream products.

A person of ordinary skill in the art would not be motivated to look for a replacement for ethylene oxide simply because it might be hazardous if used improperly. The chemical industry is familiar with how to handle toxic chemicals on a routine basis. The mere fact that a chemical is hazardous (assuming that the Examiner can substantiate his Notice) is not, in and of itself, a suggestion to replace ethylene oxide, which is one of the most commonly used and **inexpensive** hydroxyalkylation agents available, with another chemical. In addition, the mere fact that a chemical is hazardous does not provide, in and of itself, a motivation for replacing ethylene oxide.

In the present case, neither the documents cited as references, nor the knowledge generally available to one of ordinary skill in the art, provides motivation to replace ethylene oxide. Even though the hazards of ethylene oxide may be generally known, a person of ordinary skill in the art would not be motivated to embark on a search or exploration of the vast chemical literature to locate a replacement for ethylene oxide. A person of ordinary skill in the art would not be able to find a replacement that provides the unique advantages of the present invention without using information disclosed only in the Applicants' invention. Applicants respectfully point out that finding a replacement for ethylene oxide that can provide the unexpected advantages exhibited by the process of the present invention is the discovery of the present inventors. This

discovery is not part of the "knowledge generally available to one of ordinary skill in the art" (see MPEP § 2142). To reach a conclusion of obviousness that is based on knowledge available only from the Applicants' own invention is possible only through impermissible hindsight reconstruction. Accordingly, Applicants respectfully request that unless a reference containing the above information could be provided, the Examiner's Notice should be withdrawn.

Okamoto and the Examiner's Notice, either alone or in combination, are insufficient to provide motivation to a person of ordinary skill in the art to look for a replacement for ethylene oxide. There is no suggestion in Okamoto and the Examiner's Notice, alone or in combination, to modify the process disclosed by Okamoto to overcome the disadvantages of using ethylene oxide. Accordingly, Okamoto and the Examiner's Notice, alone or in combination, do not provide the requisite motivation for modifying the process disclosed by Okamoto to replace one of the most commonly used and inexpensive hydroxyalkylation agents available, with another chemical. The suggestion or the motivation for such a modification must be "either in the references themselves or in the knowledge generally available to one of ordinary skill in the art" (see MPEP § 2142 and In re Rouffet, 47 USPQ 2d at 1457-1458).

There is an additional deficiency in Okamoto and the Examiner's Notice, alone or in combination. The deficiency is that a person of ordinary skill in the art would have to be further motivated to look for a replacement for another necessary ingredient in the process described by Okamoto, namely the "tertiary amine catalyst." There is no suggestion anywhere in Okamoto that the use of a tertiary amine catalyst has a disadvantage. On the contrary, in column 3, lines 8 to 25, Okamoto states that the amine catalyst can easily be removed by the addition of an acid. Thus, Okamoto would clearly discourage a person of ordinary skill in the art to look for a replacement for the tertiary amine catalyst, and thereby teaches away from looking for a replacement therefor. Thus, a person of ordinary skill in the art would not be motivated to look for a replacement for the tertiary amine catalyst, let alone be motivated to look for a neutral phase transfer catalyst.

Needless to say, the 35 U.S.C. § 103 (a) rejection does not address this critical deficiency in Okamoto and the Examiner's Notice, either alone or taken in combination.

Without such motivation, a person of ordinary skill in the art would not be motivated to **simultaneously** look for:

(1) a replacement for ethylene oxide; and

(2) a replacement for the tertiary amine catalyst.

Without such motivation, a person of ordinary skill in the art would not be motivated to further combine Okamoto and the Examiner's Notice with Wu.

In addition, Wu describes a process for preparing polyesters of **monomeric polycarboxylic acids**. The monomeric polyfunctional carboxylic acid is derived from a **hydrocarbon** and includes the following acids (see column 3, lines 8 to 25):

oxalic acid,
malonic acid,
succinic acid,
glutaric acid,
adipic acid,
suberic acid,
azelaic acid,
sebacic acid,
1,2,3-propanetricarboxylic acid,
1,2-cyclohexane dicarboxylic acid,
1,4-cyclohexane dicarboxylic acid,
phthalic acid,
isophthalic acid,
terephthalic acid,
1,3,5-benzene tricarboxylic acid (trimesic acid),
1,2,4-benzene tricarboxylic acid (trimellitic acid), and

1,2,4,5-benzene tetracarboxylic acid (pyromellitic acid).

As seen from the above **monomeric** polycarboxylic acids, none is a dicarboxyfunctional **polymer**. Thus, there is no disclosure or suggestion and therefore, motivation, for a person of ordinary skill in the art to use the process of preparing **monomeric** carboxylic acids disclosed by Wu to prepare the **polymeric** dicarboxylic acid-functionalized materials of the present invention. The chemistry of monomeric carboxylic acids and the chemistry of polymeric acids do not belong to the same area of endeavor. Therefore, they do not belong to analogous arts. Wu describes a process for preparing polyesters from a **monomeric carboxylic acid**, not from **polymeric** dicarboxylic acid. Applicants respectfully point out that the chemical arts in general are considered to be unpredictable arts. Accordingly, knowledge obtained from the chemistry of monomeric carboxylic acids can not be extrapolated to the chemistry of polymeric acids. Therefore, a person of ordinary skill in the art would not be motivated to further modify Wu and use a **polymeric dicarboxylic acid** as a reactant instead of the **monomeric carboxylic acid** described by Wu.

In addition, controlling the molecular weight of the hydroxyalkylated final product is critical for producing a useful hydroxyalkylated final product.

In Example I, column 5, lines 43-48, of Wu, it is stated that: "The results of the above runs demonstrate that in the presence of the catalyst of the instant invention terephthalic acid and ethylene cabonate react readily to form esterified products of terephthalic acid, such as hydroxyethyl esters of terephthalic acid and higher molecular weight oligomers thereof."

In contrast to Wu, the molecular weight of the hydroxyalkylated polymer material in the process of the present invention remains substantially the same as the molecular weight of the starting dicarboxylic acid functionalized polymer material. Pages 26 to 27, Example 10, of the specification describe a molecular weight determination made on commercial HTBN, and compared with HTBN made in accordance with the present

invention. The Applicants report that a "good agreement" was found between the different sources HTBN, which indicates absence of appreciable resin extension. This is an important discovery because low fusible-materials and block prepolymer resins prepared from HTBNs and organic diisocyanates are constrained by the permissible molecular weights of their starting materials to achieve materials having appropriate physical properties. Such advantages would be lost if the original molecular weights do not remain substantially the same during hydroxyalkylation.

Thus, if Okamoto, the Examiner's Notice and Wu are combined, a much higher molecular weight material would be obtained, because the process of Wu would produce "**higher molecular weight oligomers thereof**" (see Wu, Example I, column 5, lines 47-48). Such high molecular weight materials would not be useful in the compositions of the present invention. Thus, combining Okamoto, Examiner's Notice and Wu **would destroy the intended purpose** of the hydroxyl-functional materials of the present invention.

Therefore, the 35 U.S.C. § 103(a) rejection of claims 2-5, 9 and 12-15 should be withdrawn and claims 2-5, 9 and 12-15 should be allowed.

Rejection Based on Okamoto in view of Examiner's Notice and further in view of Yoshino:

This combination does not render the instant claims obvious because Okamoto does not disclose or suggest modifying the process of Okamoto to overcome the disadvantages of using ethylene oxide, as described above in detail.

In summary:

(1) Okamoto does not provide motivation to a person of ordinary skill in the art to explore the vast literature in the relevant art to locate a replacement for ethylene oxide;

(2) the mere fact that a chemical is hazardous is not, in and of itself, a suggestion to replace ethylene oxide and, in and of itself, does not provide a motivation for replacing ethylene oxide;

(3) Okamoto and the Examiner's Notice, in combination, are insufficient to provide motivation to a person of ordinary skill in the art to look for a replacement for ethylene oxide; and

(4) Okamoto and the Examiner's Notice, either alone or in combination do not disclose, suggest, or provide motivation to a person of ordinary skill in the art to look for a replacement for the tertiary amine catalyst, let alone be motivated to look for a non-base phase transfer catalyst.

Thus, as mentioned above, without such motivation, a person of ordinary skill in the art would not be motivated to look for a replacement for ethylene oxide **and** look for a replacement for the tertiary amine catalyst.

Without such motivation, a person of ordinary skill in the art would not be motivated to further combine Okamoto and the Examiner's Notice with Yoshino.

Yoshino describes preparation of a **mixture** of **monomeric mono- and di-esters** of ethylene glycol with a **mono-carboxylic acid**, not from **polymeric dicarboxylic acid-functionalized materials**. These carboxylic acids are neither dicarboxylic acids, nor are they ordinarily polymerizable. Accordingly, a person of ordinary skill in the art would not be motivated to further modify Yoshino to provide a **polymeric dicarboxylic acid-functionalized material** as a reactant.

The issue of controlling the molecular weight of the hydroxyalkylated final product is critical for producing a useful hydroxyalkylated final product. Applicants' objective is to minimize the amount of undesirable reaction, such as, chain extension, aside from the desirable hydroxylakylation reaction on the two carboxylic acid functional groups. By so doing, the molecular weight of the hydroxyalkylated polymer material remains substantially the same as the molecular weight of the starting dicarboxylic acid

functionalized polymer material. Pages 26 to 27, Example 10, of the specification describe a molecular weight determination made on commercial HTBN, and compared with HTBN made in accordance with the present invention. Applicants report that "good agreement" was found between the different sources HTBN, which is indicative of no appreciable resin extension as a result of the inventive process.

This is an important discovery because HTBNs react rapidly through their terminal hydroxyl groups with organic diisocyanates to form solid, high molecular weight materials of low fusibility. They are also used in particular to form block prepolymer resins. Such low fusible-materials and block prepolymer resins are constrained by the permissible molecular weights of their starting materials to achieve materials having appropriate physical properties. Such advantages would be lost if the original molecular weights do not remain substantially the same during hydroxyalkylation. Thus, if Okamoto and the Examiner's Notice is combined with Yoshino, much higher molecular weight materials would be obtained that are not useful in the compositions of the present invention. Thus, combining Okamoto, the Examiner's Notice and Yoshino **would destroy the intended purpose** of the hydroxyl-functional materials of the present invention.

In addition, as an unexpected result, HTBN prepared according to the present invention exhibits certain properties, unlike those of conventionally prepared HTBN's which can be attributed to the absence of ethylene glycol in the HTBN. The **absence of ethylene glycol** as an impurity in the HTBN prepared according to the present invention results in an **improved performance** in certain applications, such as, in the preparation of urethane block co-polymers, which exhibit an improved toughness compared to HTBN derived from conventional processes that use ethylene oxide.

In the process according to the present invention, the hydroxyalkylating reagent, as well as the phase transfer catalyst, are non-toxic and require neither special handling conditions nor equipment. The process according to this invention also does not require a solvent for reaction and in one aspect does not require a solvent for separation or

purification. In addition, at least the prior process, which employs ethylene oxide, also requires a trialkyl amine catalyst, the entire removal of which at the completion of the reaction is difficult and the presence of which (even in residual amounts) frequently results in premature polymerization of block resins formed from HTBN.

The obviousness rejection based on the combination of Okamoto and the Examiner's Notice with Wu or Yoshino requires a person of ordinary skill in the art to **simultaneously:**

(1) **replace ethylene oxide with ethylene carbonate**;

(2) **replace the tertiary amine catalyst with a phase transfer catalyst**;

(3) **devise a process in which the original molecular weights do remain substantially the same** during the entire process so as not to destroy the intended purpose of the hydroxyl-functional materials of the present invention; and

(4) produce the unexpected **improved performance resulting from the absence of ethylene glycol** as an impurity in the HTBN.

The above references fail to provide a motivation for a person of ordinary skill in the art to combine Okamoto, the Examiner's Notice with Wu or Yoshino. Absent a teaching or suggestion, the references cited above are not properly combinable because a person of ordinary skill in the art would have no motivation to combine.

A showing of motivation is one of the essential requirements that must be met to establish a *prima facie* case of obviousness (see MPEP § 2142 and In re Rouffet, 47 USPQ 2d at 1457-1458). In addition, none of the cited references teach or suggest the desirability of **simultaneously** (1) replacing ethylene oxide with ethylene carbonate and (2) replacing the tertiary amine catalyst with a phase transfer catalyst (see MPEP 2143.01). Thus, without a showing of the requisite motivation for **simultaneously** replacing ethylene oxide with ethylene carbonate and the tertiary amine catalyst with a phase transfer catalyst, the rejection is improper.

Accordingly, Applicants respectfully request reconsideration of the present application, withdrawal of the 35 U.S.C. §103 (a) rejection of claims 2-5, 9 and 12 -15 and allowance of the pending and newly presented claims, namely claims 2-5, 9, 12 - 15, 21 and 22.

Applicants also respectfully request rejoining claims 6-7, 10-11 and 19 -20, which are currently withdrawn from consideration by the Examiner for being drawn to non-elected species of the present invention, and allowance of claims 2-7, 9-15 and 19-22.

It is respectfully submitted that this is a full and complete response to the office action and that all claims are allowable for at least the reasons stated. An early indication of their allowability by issuance of a Notice of Allowability is earnestly solicited.

Respectfully submitted,

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By: V. Alexanian

Vazken A. Alexanian
Registration No. 37,270
Ohlandt , Greeley, Ruggiero & Perle, L.L.P.
One Landmark Square, 10th Floor
Stamford,Connecticut 06901-2682
U.S.A.
Telephone: (203) 327- 4500
Telefax: (203) 327- 6401

VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS:

Claim 1 and 8 have been cancelled.

Claim 2 has been amended as follows:

2. (Twice Amended) [~~The process according to Claim 1, wherein said~~] A process for preparing a dihydroxyl-functionalized material by hydroxyalkylating a dicarboxylic acid-functionalized material, said process comprising the step of: reacting as reactants: (a) a dicarboxylic acid-functionalized material [~~is~~] selected from the group consisting of [~~the~~] dicarboxylic acid-functionalized polymers of: polybutadiene, poly(butadiene-co-acrylonitrile), [~~,~~] poly(acrylonitrile) and combinations thereof [~~,~~] ; and (b) a hydroxyalkylating reagent selected from the group consisting of: a carbocyclic carbonate and a carbocyclic sulfite; in the presence of: (c) a phase transfer catalyst under conditions sufficient to form the dihydroxyl-functionalized material.

14. (Twice Amended) The process according to Claim [~~1~~] 2, wherein the molar ratio of the hydroxyalkylating reagent to the dicarboxylic acid-functionalized material is from about [~~4~~] 3.8 to about [~~5~~] 4.5.

The following new claims have been added:

-- 21. The process according to Claim 2, wherein said dicarboxylic acid-functionalized material has carboxyl-functional groups independently selected from the group consisting of: R and R^1, wherein each R and R^1 is independently selected from the group consisting of: COOH or CAA^1-X-COOH, wherein each A and A^1 is independently selected from the group consisting of: hydrogen, halogen, cyano, linear or branched alkyl having from 1 to about 5 carbon atoms and wherein X is a linear or branched alkyl having from 1 to about 5 carbon atoms.

22. The process according to Claim 2, wherein said dicarboxylic acid-functionalized material has a molecular weight of from about 3,100 to about 4,200. --